Interactive comment on "Deforestation reduces the vegetation-accessible water storage in the unsaturated soil and affects catchment travel time distributions and young water fractions" *by* Markus Hrachowitz et al.

Anonymous Referee #4

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This manuscript presents the effects of partial deforestation on water storage and water ages in the German Wüstebach catchment. For this study, the authors performed water balance analyses and modelling exercises based on 7 years of hydrometric and water stable isotope data. One major finding of the study is that the vegetation-accessible storage volume in the unsaturated zone, *SUmax*, was significantly reduced after the partial deforestation; the authors hypothesize that this reduction in *SUmax* can largely be explained with young water being routed quickly to the stream during wet conditions, so that less water reached the unsaturated zone *SU*.

The paper is well written and the figures are informative. I only have some minor comments and questions that the authors should address.

1. The physical meaning of *SUmax* not fully clear to me: its definition in the introduction is "water-filled pore volume between field capacity and permanent wilting point that is within the reach of active roots". This suggests that *SUmax* depends on water content in the soil and the active rooting depth. Does this mean that *SUmax* will decrease when water influx is reduced and/or roots become shorter? Then, the major result of the study (i.e., *SUmax* is reduced after deforestation; L421-424) is not surprising but rather expected because fewer roots will lead to a smaller catchment-average active rooting depth.

2. L135: How many measurements of rooting depth are available to justify the general assumption that the maximum rooting depth across the catchment is 50cm? What is the depth of the groundwater table and is it possible that capillary rise from the groundwater supplies these shallow-rooted plants?

3. Are there any additional data that support your claim of a large groundwater storage in the Wüstebach catchment? It is surprising to me that no groundwater table and soil moisture observations have been considered for explaining many of the processes you propose.

4. How were dry, drying, wet and wetting-up periods defined (L545, L561, Fig. 8)?

5. Fig. 8 and Sect. 5.3: How was the daily young water fraction calculated and what is the associated uncertainty? Are your interpretations robust with respect to the uncertainties in *Fyw*?

6. L434: From Fig 2d it is hard to see how well the model simulated the δ18O time series because the data points cover each other too much.

7. Fig 8d, c: It is not clear to me, which data points were used to obtain these regression lines? Especially the dark-blue regression lines (wet conditions) do not seem to fit the

dark blue data points at all, and thus, the associated regression slopes should be considered with caution (e.g. in L588).

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